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Exhibit C.

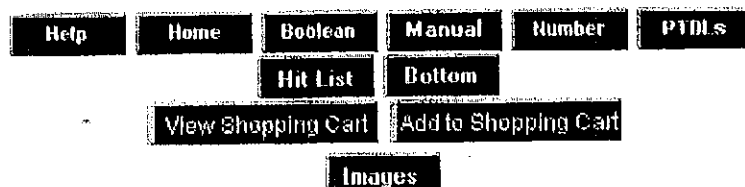
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United States Patent Application: 0040258571

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(1 of 1)

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Fluidic arrays and method of using

Abstract

The present invention relates to fluidic systems and, in particular, fluidic arrays and methods for using them to promote interaction of materials. In one embodiment, the present invention is directed to a microfluidic system. The microfluidic system includes a first fluid path and a second fluid path segregated from the first fluid path by a first convection controller at a first contact region, wherein at least one of the first fluid path and the second fluid path has a cross-sectional dimension of less than about 1 millimeter. In another aspect, the present invention is directed to a method of promoting interaction. In another aspect, the invention relates to a device and method for performing titrations.

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Government Interests

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Claims

1. A microfluidic system, comprising: a first fluid path; a second fluid path segregated from the first fluid path by a first convection controller at a first contact region; wherein at least one of the first fluid path and the second fluid path has a cross-sectional dimension of less than about 1 mm.
2. The microfluidic system of claim 1, wherein the first fluid path and the second fluid path are substantially tangentially intersecting at the first contact region.
3. The microfluidic system of claim 1, wherein at least one of the first fluid path and the second fluid path is substantially rectangular in cross-section at the first contact region.
4. The microfluidic system of claim 1, wherein the first fluid path and the second fluid path have a crossing angle between about 45 and 135 degrees.
5. The microfluidic system of claim 4, wherein the first fluid path and the second fluid path have a crossing angle of about 90 degrees.
6. The microfluidic system of claim 1, wherein the convection controller is permeable by diffusion.
7. The microfluidic system of claim 6, wherein the convection controller has an affinity for at least one material to be used within the microfluidic system and repulses at least one material to be used within the microfluidic system.
8. The microfluidic system of claim 7, wherein the convection controller carries an electrical charge.
9. The microfluidic system of claim 6, wherein the convection controller comprises pores about 0.05 to 0.2 micrometers in average diameter.
10. The microfluidic system of claim 9, wherein the inhibitor comprises pores about 0.1 micrometers in diameter.
11. The microfluidic system of claim 6, wherein the convection controller comprises a portion about 5 to 50 microns thick.
12. The microfluidic system of claim 11, wherein the convection controller comprises a portion about 10

microns thick.

13. The microfluidic system of claim 6, wherein the convection controller comprises a membrane.

14. The microfluidic system of claim 13, wherein the membrane comprises polycarbonate.

15. The microfluidic system of claim 1, further comprising an interaction material positioned within one of the first fluid path and the second fluid path.

16. The microfluidic system of claim 15, wherein the interaction material is one of a test fluid and an indicator.

17. The microfluidic system of claim 15, wherein the interaction material is immobilized within the one of the first fluid path and the second fluid path.

18. The microfluidic system of claim 1, wherein the convection controller comprises: a first membrane; and a second membrane in spaced relation to the first membrane.

19. The microfluidic system of claim 18, wherein the first membrane and the second membrane are no more than 500 micrometers apart.

20. The microfluidic system of claim 19, wherein the first membrane and the second membrane are no more than 250 micrometers apart.

21. The microfluidic system of claim 20, wherein the first membrane and the second membrane are no more than 100 micrometers apart.

22. The microfluidic system of claim 1, further comprising: a third fluid path segregated from the second fluid path by a second convection controller at a second contact region; and a fourth fluid path segregated from the first fluid path by a third convection controller at a third contact region and segregated from the third fluid path by a fourth convection controller at a fourth contact region.

23. The microfluidic system of claim 22, wherein the first convection controller, the second convection controller, the third convection controller and the fourth convection controller comprise a single convection controller.

24. The microfluidic system of claim 22, wherein at least one of the first fluid path and the second fluid path comprises a cross-sectional dimension of less than about 300 μm .

25. The microfluidic system of claim 24, wherein at least one of the first fluid path and the second fluid path comprises a cross-sectional dimension of less than about 100 μm .

26. The microfluidic system of claim 25, wherein at least one of the first fluid path and the second fluid path comprises a cross-sectional dimension of less than about 50 μm .

27. The microfluidic system of claim 1, wherein both the first fluid path and the second fluid path have a cross-sectional dimension of less than about 500 μm .

28. A fluidic system, comprising: a first fluid path; a second fluid path; a third fluid path segregated from the first fluid path by a convection controller at a first contact region and the second fluid path by a convection controller at a second contact region; and a fourth fluid path segregated from the first fluid path by a

convection controller at a third contact region and segregated from the second fluid flow path by a fourth convection controller at a fourth contact region.

29. A fluidic array, comprising: a first set of fluid paths arranged generally parallel to one another; a second set of fluid paths arranged generally parallel to one another and crossing the first set of fluid paths such that a plurality of contact regions are formed between at least some of the fluid paths in the first set of fluid paths and at least some of the fluid paths in the second set of fluid paths; and a convection controller segregating one of the first set of fluid paths from one of the second set of fluid paths at the contact region.

30. A method of promoting interaction, comprising: introducing a first fluid including a first material into a first fluid path having a cross-sectional dimension of less than 1 millimeter; introducing a second fluid including a second material into a second fluid path segregated from the first fluid path by a convection controller at a contact region; and allowing the first and second materials to interact at the contact region.

31. The method of promoting interaction of claim 30, further comprising maintaining a pressure within the first fluid path at the contact region substantially equal to a pressure within the second fluid path at the contact region.

32. The method of promoting interaction of claim 30, further comprising diffusing at least one of the first material and the second material into the convection controller.

33. The method of promoting interaction of claim 30, further comprising flowing at least one of the first fluid through the first fluid path and the second fluid through the second fluid path.

34. The method of promoting interaction of claim 30, further comprising immobilizing at least one of the first fluid in the first fluid path and the second fluid in the second fluid path.

35. The method of promoting interaction of claim 30, wherein the first fluid is the first material.

36. The method of promoting interaction of claim 30, wherein the second fluid is the second material.

37. A method of immobilizing a material in a microfluidic system, comprising: introducing an immobilizer containing the material into a fluid path having a cross-sectional dimension of less than about 1 millimeter.

38. The method of immobilizing a material in a microfluidic system of claim 37, wherein introducing the immobilizer comprises flowing an immobilizer comprising a flowable gel into the fluid path.

39. The method of immobilizing a material in a microfluidic system of claim 37, wherein introducing the immobilizer comprises flowing the immobilizer into the fluid path and allowing the immobilizer to set within the fluid path.

40. A microfluidic system, comprising a fluid path having a cross-sectional dimension of less than about 1 millimeter; an immobilizer positioned within the fluid path.

41. The microfluidic system of claim 40, wherein the immobilizer comprises a gel.

42. The microfluidic system of claim 41, wherein the immobilizer comprises a flowable gel.

43. The microfluidic system of claim 40, wherein the immobilizer comprises a test material.

44. The microfluidic system of claim 40, wherein the immobilizer comprises an indicator material.

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45. The microfluidic system of claim 40, wherein at least 5% of the fluid path is occupied by the immobilizer at least one point in the fluid path.
46. The microfluidic system of claim 45, wherein at least 25% of the fluid path is occupied by the immobilizer at least one point in the fluid path.
47. The microfluidic system of claim 46, wherein at least 50% of the fluid path is occupied by the immobilizer at least one point in the fluid path.
48. A method of patterning a material on a substrate, comprising: placing a first fluid path in fluid contact with the substrate; flowing a fluid comprising the material into the first fluid path; immobilizing at least a portion of the material within the first fluid path; removing the first fluid path from the substrate, leaving at least a portion of the immobilized material in contact with the substrate; and placing a second fluid path in fluid contact with the substrate such that the second fluid path is in fluid contact with at least a portion of the immobilized material.
49. The method of claim 48, wherein immobilizing further comprises adsorbing a portion of the fluid onto the substrate.
50. The method of claim 48, wherein removing comprises removing the fluid path from the substrate such that the immobilized material is not substantially damaged.
51. The method of claim 48, wherein placing further comprises placing a first plurality of fluid paths in contact with the substrate and flowing further comprises flowing a plurality of fluids into the first plurality of fluid paths.
52. The method of claim 48, wherein placing a first fluid path further comprises placing a first fluid path having a cross-sectional dimension of less than 1 millimeter in fluid contact with the substrate.
53. A fluidic device, comprising: a substrate with a material patterned thereon; and a fluid path in fluid contact with the substrate such that the fluid path is in fluid contact with at least a portion of the material.
54. The fluidic device of claim 53, wherein the material is patterned onto the substrate in at least one strip.
55. The fluidic device of claim 54, wherein the material is patterned onto the substrate in a plurality of strips.
56. The fluidic device of claim 55, wherein at least portions of the plurality of strips are substantially linear.
57. The fluidic device of claim 56, wherein the portions of the plurality of strips that are substantially linear are substantially parallel.
58. The fluidic device of claim 53, further comprising a plurality of fluid paths.
59. The fluidic device of claim 58, wherein at least portions of the plurality of fluid paths are substantially linear.
60. The fluidic device of claim 59, wherein the portions of the plurality of fluid paths that are substantially linear are substantially parallel.
61. The fluidic device of claim 60, wherein the material is patterned onto the substrate in a plurality of strips,